INTRODUCCIÓN

El excelente libro *Manual para el proyecto de estructuras de concreto armado para edificaciones* de los Ingenieros **Enrique Arnal** y **Salomón Epelboim**; realizado en el año 1.984 bajo solicitud y auspicios del Ministerio del Desarrollo Urbano de la República de Venezuela; editado por la Fundación Juan José Aguerrevere, Fondo Editorial del Colegio de Ingenieros de Venezuela; y basado en la Norma de *Estructuras de concreto armado para edificios* Covenin-Mindur 1753, en la Norma para *Edificaciones antisísmicas* Covenin-Mindur 1756, en la Norma de *Acciones mínimas para el proyecto de edificaciones* Covenin-Mindur 2002, en la Norma para el *Cálculo de la acción del viento en el proyecto de edificaciones* Covenin-Mindur y en la vasta experiencia de los autores, ha sido durante muchos años referencia obligada para el diseño de estructuras de concreto armado.

El éxito de este libro fue notable, y se agotó la existencia de todas sus ediciones. Actualmente solo circulan los ejemplares que tenemos quienes pudimos adquirirlo en su oportunidad. Más allá de ser un manual, esta obra constituye un libro de texto.

Mucha de la información contenida en este manual es perecedera, puesto que está referenciada a la normativa vigente para la época. Sin embargo, contiene información invaluable de carácter teórico, además de criterios para el buen diseño, que trascienden al tiempo y a las sucesivas normas. Es por este motivo que me he dado a la tarea de digitalizar algunos capítulos que siguen –y seguirán- vigentes, para el libre acceso de aquellos colegas que lo requieran. Cabe acotar que queda a juicio del ingeniero proyectista seguir los criterios expuestos en este texto, cuando sean aplicables, puesto que no son prescriptivos.

Debido a que es un producto que fue realizado por el gobierno nacional, y cuya data es de hace 25 años, no pienso que no pueda pertenecer al dominio público, tal como hoy día ocurre con las Normas Covenin. Esta difusión pública se ha realizado sin el permiso previo para ello.

Antolín Martínez A.
Puerto Ordaz, Julio 2010

CAPÍTULO 8 – SECCIÓN 8.1

Escaleras helicoidales.

ASPECTOS GENERALES

Las escaleras helicoidales son estructuras de gran elegancia y funcionalidad a menudo empleadas en espacios donde se desea obtener cierto carácter de belleza sobria y distinguida.

Existen diversas variantes de éllas como por ejemplo, las apoyadas en un eje central, comunmente llamadas escaleras de caracol; las de viga central en hélice y las de losa helicoidal empotrada en sus extremos que es la tratada en este caso.

PARAMETROS Y METODOS DE CALCULO

α : pendiente de la escalera; en el cálculo de las tablas se tomó $\alpha = 29°$;

ϕ_o : ángulo al centro de la escalera. Se trabajó con los siguientes valores: 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330 y 360 grados;

$\frac{b}{r}$: es el cuociente entre el ancho de la escalera y su radio; se tomaron los siguientes valores: 0.50; 0.75; 1.00; 1.50; 2.00 ; 2.50 y 3.00;

$\frac{h}{b}$: es el cuociente entre el espesor de la losa y su ancho; se tomaron los siguientes valores: 0.10; 0.15; 0.20 y 0.25.

El cálculo se hizo siguiendo el método de Fuchsteiner el cual es una variante del método de las acciones. Se obtienen valores de las siguientes solicitaciones: fuerza axial, fuerzas cortantes, momentos flectores y momento torsor.

Estas solicitaciones se calcularon para los siguientes puntos:

$\phi = 0$ (Sección A)

$\phi = \phi_o/4$ (Sección B)

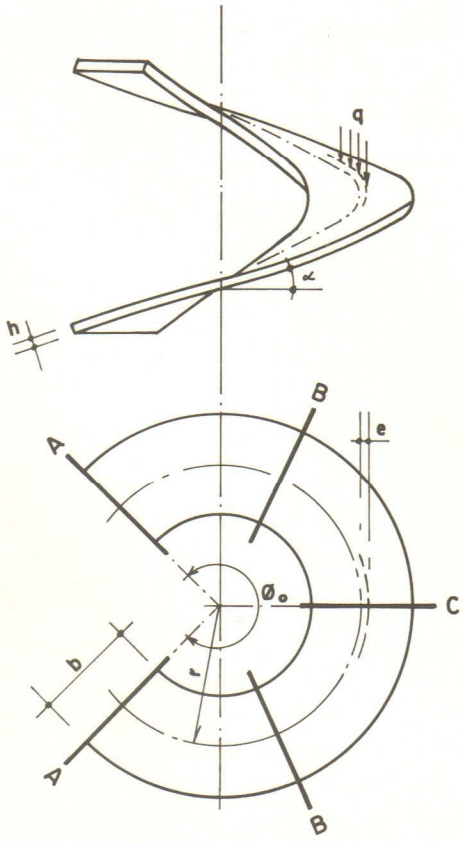
$\phi = \phi_o/2$ (Sección C)

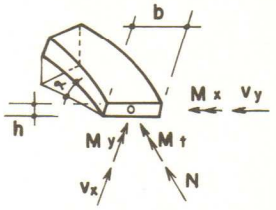
y que corresponden a los apoyos, a la cuarta parte del recorrido y al punto medio.

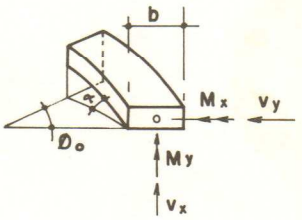
BIBLIOGRAFIA

- Beton Kalender
  Ed Wilhelm Ernst & Sohn, Berlín, 1952.

- Franz Schuster
  Escaleras, Ed. Blume, Barcelona, 1964.







SECCION A = APOYO

SECCION B = 1/4 L

SECCION C = 1/2 L

L = LONGITUD TOTAL DE LA ESCALERA.

SOLICITACIONES :

N = FUERZA AXIAL = $n\,q\,r$

V_x = FUERZA CORTANTE VERTICAL = $V_x\,q\,r$

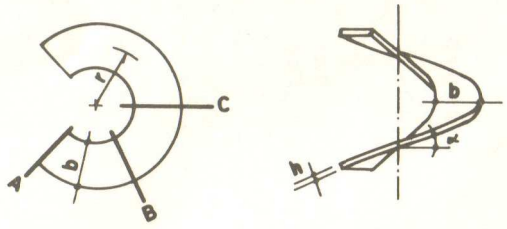
V_y = FUERZA CORTANTE HORIZONTAL = $V_y\,q\,r$

M_t = MOMENTO TORSOR = $t\,q\,r^2$

M_x = MOMENTO FLECTOR EN X = $m_x\,q\,r^2$

M_y = MOMENTO FLECTOR EN Y = $m_y\,q\,r^2$

TABLA Nº 8.1



h / b = 0.10

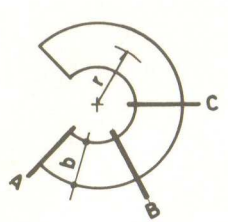
b / r = 0.50

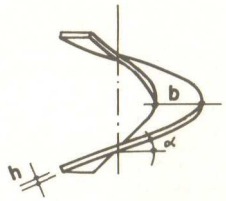
∝ = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	ϕ_o	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.731	1.879	1.947	1.932	1.841	1.681	1.461	1.188	0.871	0.523	0.193
	v_x	2.748	2.333	1.952	1.615	1.324	1.075	0.864	0.687	0.539	0.415	0.309	0.193
	v_y	1.541	1.430	1.207	0.920	0.605	0.292	0.000	-0.253	-0.449	-0.561	-0.534	-0.281
	t	0.401	0.183	0.071	0.019	-0.004	-0.012	-0.015	-0.015	-0.014	-0.012	-0.009	-0.005
	m_x	-1.536	-1.064	-0.701	-0.444	-0.274	-0.168	-0.105	-0.071	-0.054	-0.044	-0.034	-0.016
	m_y	-0.222	-0.539	-0.836	-1.062	-1.197	-1.239	-1.194	-1.071	-0.881	-0.634	-0.347	-0.083
B	n	2.109	1.982	1.812	1.622	1.425	1.227	1.031	0.838	0.647	0.456	0.266	0.097
	v_x	0.627	0.548	0.492	0.448	0.408	0.368	0.326	0.284	0.240	0.196	0.152	0.096
	v_y	0.000	-0.193	-0.361	-0.498	-0.605	-0.686	-0.743	-0.776	-0.778	-0.733	-0.595	-0.288
	t	0.176	0.095	0.047	0.019	0.002	-0.007	-0.012	-0.014	-0.013	-0.011	-0.007	-0.003
	m_x	0.321	0.239	0.163	0.102	0.058	0.030	0.014	0.006	0.003	0.003	0.003	0.002
	m_y	-1.860	-1.731	-1.565	-1.384	-1.200	-1.019	-0.843	-0.673	-0.506	-0.341	-0.178	-0.042
C	v_y	-1.541	-1.481	-1.394	-1.300	-1.210	-1.123	-1.051	-0.978	-0.898	-0.793	-0.616	-0.291
	m_x	-0.506	-0.343	-0.223	-0.138	-0.080	-0.041	-0.016	0.001	0.011	0.015	0.015	0.008
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.2





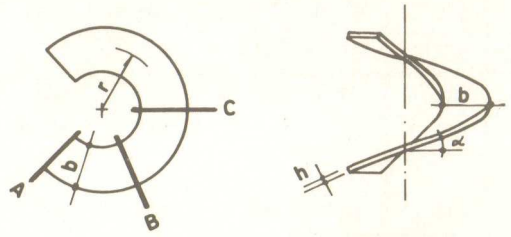
h / b = 0.10

b / r = 0.75

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø°	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.736	1.888	1.961	1.951	1.863	1.704	1.484	1.209	0.888	0.534	0.197
	v_x	2.748	2.330	1.947	1.607	1.313	1.063	0.851	0.674	0.527	0.406	0.303	0.190
	v_y	1.560	1.450	1.226	0.936	0.617	0.298	0.000	-0.260	-0.463	-0.580	-0.555	-0.298
	t	0.372	0.152	0.039	-0.013	-0.035	-0.042	-0.042	-0.040	-0.035	-0.029	-0.020	-0.011
	m_x	-1.561	-1.084	-0.716	-0.455	-0.231	-0.173	-0.108	-0.073	-0.055	-0.045	-0.035	-0.017
	m_y	-0.206	-0.528	-0.831	-1.063	-1.203	-1.250	-1.209	-1.088	-0.897	-0.647	-0.355	-0.085
B	n	2.126	2.000	1.831	1.641	1.443	1.244	1.047	0.853	0.659	0.465	0.272	0.099
	v_x	0.618	0.538	0.482	0.437	0.397	0.358	0.317	0.276	0.233	0.191	0.149	0.095
	v_y	0.000	-0.196	-0.366	-0.507	-0.617	-0.702	-0.762	-0.798	-0.802	-0.758	-0.619	-0.306
	t	0.168	0.085	0.035	0.007	-0.010	-0.020	-0.024	-0.025	-0.023	-0.019	-0.013	-0.006
	m_x	0.311	0.230	0.154	0.093	0.050	0.023	0.007	0.001	-0.001	0.001	0.002	0.002
	m_y	-1.876	-1.749	-1.583	-1.402	-1.217	-1.035	-0.858	-0.686	-0.516	-0.348	-0.182	-0.043
C	v_y	-1.560	-1.501	-1.416	-1.324	-1.235	-1.153	-1.078	-1.005	-0.926	-0.820	-0.641	-0.308
	m_x	-0.533	-0.366	-0.243	-0.156	-0.095	-0.053	-0.025	-0.006	0.006	0.013	0.014	0.008
	$n = v_x = t = m_y = 0$												



h / b = 0.10

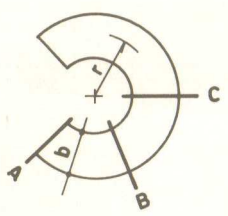
b / r = 1.00

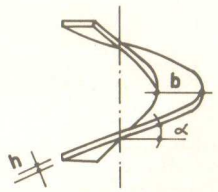
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.743	1.902	1.981	1.977	1.893	1.737	1.516	1.239	0.912	0.549	0.202
	v_x	2.748	2.327	1.939	1.596	1.299	1.046	0.833	0.656	0.511	0.393	0.294	0.187
	v_y	1.586	1.478	1.253	0.960	0.635	0.308	0.000	-0.270	-0.482	-0.607	-0.585	-0.321
	t	0.333	0.109	-0.006	-0.058	-0.078	-0.083	-0.081	-0.074	-0.065	-0.052	-0.037	-0.019
	m_x	-1.597	-1.112	-0.736	-0.469	-0.291	-0.179	-0.112	-0.076	-0.057	-0.046	-0.036	-0.017
	m_y	-0.184	0.513	-0.824	-1.064	-1.213	-1.267	-1.230	-1.111	-0.920	-0.665	-0.366	-0.088
B	n	2.148	2.025	1.857	1.667	1.469	1.270	1.070	0.873	0.676	0.478	0.280	0.101
	v_x	0.605	0.524	0.467	0.423	0.383	0.344	0.305	0.264	0.224	0.184	0.144	0.093
	v_y	0.000	-0.200	-0.375	-0.519	-0.635	-0.724	-0.789	-0.828	-0.836	-0.793	-0.652	-0.330
	t	0.156	0.070	0.020	-0.010	-0.028	-0.037	-0.041	-0.041	-0.038	-0.031	-0.021	-0.010
	m_x	0.297	0.217	0.141	0.081	0.039	0.013	-0.001	-0.006	-0.005	-0.002	-0.001	-0.001
	m_y	-1.899	-1.773	-1.609	-1.427	-1.241	-1.058	-0.879	-0.704	-0.531	-0.359	-0.188	-0.044
C	v_y	-1.586	-1.530	-1.447	-1.356	-1.269	-1.189	-1.115	-1.044	-0.965	-0.858	-0.675	-0.333
	m_x	-0.570	-0.399	-0.272	-0.180	-0.116	-0.070	-0.038	-0.016	0.000	0.009	0.013	0.007
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.4





h / b = 0.10

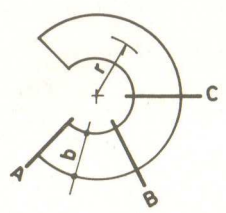
b / r = 1.50

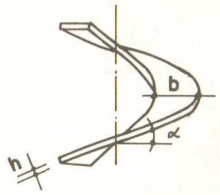
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.761	1.941	2.039	2.051	1.979	1.830	1.609	1.323	0.979	0.592	0.218
	v_x	2.748	2.316	1.918	1.564	1.258	0.998	0.782	0.605	0.464	0.356	0.271	0.178
	v_y	1.660	1.557	1.329	1.025	0.683	0.334	0.000	-0.298	-0.538	-0.684	-0.669	-0.389
	t	0 220	-0.015	-0.134	-0.186	-0.203	-0.202	-0.190	-0.172	-0.148	-0.118	-0.083	-0.043
	m_x	-1.699	-1.192	-0.795	-0.511	-0.320	-0.197	-0.124	-0.083	-0.062	-0.051	-0.039	-0.019
	m_y	-0.122	-0.469	-0.803	-1.069	-1.241	-1.314	-1.291	-1.178	-0.983	-0.716	-0.396	-0.096
B	n	2.214	2.096	1.932	1.743	1.543	1.340	1.136	0.931	0.724	0.514	0.302	0.109
	v_x	0.569	0.484	0.426	0.381	0.342	0.305	0.263		0.197	0.164	0.132	0.089
	v_y	0.000	-0.210	-0.397	-0.555	-0.683	-0.786	-0.864	-0.915	-0.932	-0.893	-0.746	-0.399
	t	0.122	0.030	-0.026	-0.059	-0.078	-0.088	-0.090	-0.087	-0.078	-0.063	-0.044	-0.022
	m_x	0.258	0.179	0.104	0.045	0.006	-0.017	-0.026	-0.025	-0.019	-0.010	-0.003	-0.004
	m_y	-1.966	-1.844	-1.681	-1.499	-1.310	-1.122	-0.937	-0.754	-0.572	-0.388	-0.204	-0.048
C	v_y	-1.660	-1.612	-1.535	-1.450	-1.367	-1.291	-1.221	-1.153	-1.076	-0.967	-0.773	-0.403
	m_x	-0.572	-0.494	-0.354	-0.251	-0.175	-0.119	-0.076	-0.043	-0.018	0.000	0.009	0.007
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.5





h / b = 0.10

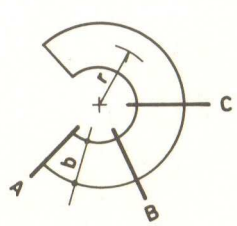
b / r = 2.00

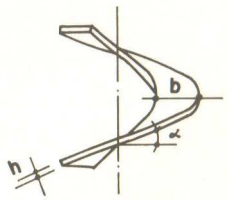
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.787	1.995	2.120	2.154	2.100	1.960	1.738	1.440	1.073	0.652	0.240
	v_x	2.748	2.302	1.888	1.519	1.200	0.931	0.710	0.533	0.399	0.303	0.238	0.166
	v_y	1.764	1.669	1.437	1.117	0.752	0.371	0.000	-0.338	-0.616	-0.791	-0.788	-0.484
	t	0.061	-0.188	-0.313	-0.365	-0.377	-0.367	-0.344	-0.310	-0.266	-0.211	-0.147	-0.076
	m_x	-1.842	-1.303	-0.878	-0.569	-0.359	-0.223	-0.141	-0.094	-0.069	-0.056	-0.044	-0.021
	m_y	-0.034	-0.407	-0.775	-1.075	-1.280	-1.380	-1.376	-1.271	-1.072	-0.788	-0.438	-0.106
B	n	2.305	2.196	2.036	1.848	1.647	1.439	1.228	1.013	0.792	0.565	0.333	0.121
	v_x	0.519	0.429	0.368	0.323	0.285	0.250	0.217	0.187	0.159	0.136	0.115	0.083
	v_y	0.000	-0.226	-0.429	-0.605	-0.752	-0.873	-0.969	-1.036	-1.067	-1.034	-0.879	-0.497
	t	0.074	-0.027	-0.089	-0.127	-0.148	-0.158	-0.159	-0.151	-0.134	-0.109	-0.076	-0.039
	m_x	0.203	0.126	0.053	-0.004	-0.040	-0.057	-0.060	-0.052	-0.038	-0.022	-0.008	-0.001
	m_y	-2.058	-1.943	-1.782	-1.599	-1.407	-1.213	-1.020	-0.826	-0.630	-0.429	-0.227	-0.053
C	v_y	-1.764	-1.728	-1.659	-1.580	-1.504	-1.434	-1.370	-1.306	-1.231	-1.119	-0.909	-0.501
	m_x	-0.825	-0.626	-0.470	-0.350	-0.258	-0.186	-0.129	-0.082	-0.043	-0.014	0.003	0.006
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.6





h / b = 0.10

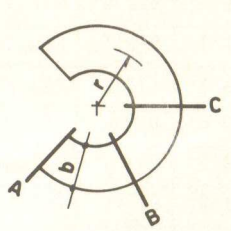
b / r = 2.50

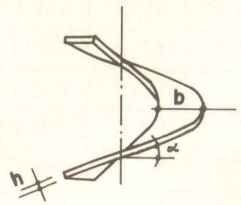
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.821	2.064	2.223	2.288	2.255	2.127	1.905	1.592	1.194	0.729	0.269
	v_x	2.748	2.283	1.849	1.462	1.127	0.845	0.617	0.441	0.315	0.236	0.195	0.150
	v_y	1.898	1.812	1.574	1.236	0.840	0.419	0.000	-0.389	-0.716	-0.930	-0.940	-0.606
	t	-0.144	-0.410	-0.544	-0.596	-0.602	-0.581	-0.541	-0.486	-0.416	-0.330	-0.230	-0.118
	m_x	-2.025	-1.447	-0.984	-0.644	-0.410	-0.256	-0.162	-0.107	-0.079	-0.064	-0.049	-0.024
	m_y	0.080	-0.328	-0.738	-1.083	-1.330	-1.465	-1.485	-1.391	-1.187	-0.880	-0.493	-0.120
B	n	2.422	2.325	2.170	1.984	1.780	1.567	1.346	1.118	0.880	0.631	0.373	0.135
	v_x	0.454	0.358	0.294	0.247	0.211	0.179	0.152	0.129	0.111	0.100	0.093	0.075
	v_y	0.000	-0.245	-0.470	-0.669	-0.840	-0.985	-1.104	-1.193	-1.240	-1.215	-1.048	-0.622
	t	0.012	-0.100	-0.171	-0.214	-0.238	-0.249	-0.247	-0.233	-0.206	-0.168	-0.118	-0.060
	m_x	0.132	0.058	-0.013	-0.067	-0.099	-0.110	-0.104	-0.086	-0.062	-0.036	-0.015	-0.002
	m_y	-2.177	-2.071	-1.913	-1.728	-1.531	-1.329	-1.125	-0.917	-0.704	-0.483	-0.256	-0.060
C	v_y	-1.898	-1.876	-1.818	-1.748	-1.680	-1.618	-1.561	-1.504	-1.431	-1.315	-1.085	-0.627
	m_x	-1.016	-0.795	-0.618	-0.477	-0.365	-0.273	-0.196	-0.131	-0.076	-0.032	-0.004	0.005
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.7





h / b = 0.10

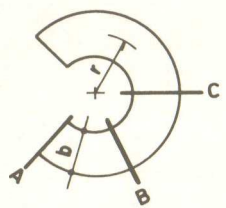
b / r = 3.00

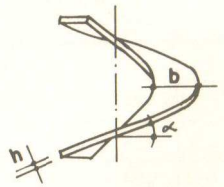
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.862	2.149	2.350	2.451	2.445	2.331	2.108	1.777	1.342	0.823	0.304
	v_x	2.748	2.261	1.802	1.391	1.036	0.740	0.504	0.328	0.212	0.154	0.143	0.131
	v_y	2.062	1.987	1.742	1.381	0.947	0.477	0.000	-0.452	-0.838	-1.099	-1.126	-0.755
	t	-0.393	-0.682	-0.825	-0.877	-0.876	-0.841	-0.783	-0.702	-0.600	-0.476	-0.331	-0.170
	m_x	-2.250	-1.622	-1.114	-0.736	-0.472	-0.297	-0.188	-0.124	-0.090	-0.072	-0.056	-0.027
	m_y	0.218	-0.231	-0.693	-1.093	-1.391	-1.568	-1.618	-1.537	-1.327	-0.993	-0.560	-0.137
B	n	2.565	2.482	2.334	2.149	1.943	1.723	1.491	1.246	0.987	0.711	0.421	0.153
	v_x	0.374	0.271	0.203	0.156	0.120	0.093	0.072	0.058	0.052	0.055	0.066	0.065
	v_y	0.000	-0.269	-0.521	-0.748	-0.947	-1.122	-1.269	-1.384	-1.451	-1.436	-1.256	-0.775
	t	-0.063	-0.190	-0.271	-0.320	-0.349	-0.360	-0.355	-0.333	-0.295	-0.239	-0.168	-0.086
	m_x	0.046	-0.025	-0.094	-0.144	-0.170	-0.174	-0.158	-0.128	-0.091	-0.054	-0.022	-0.004
	m_y	-2.323	-2.226	-2.072	-1.886	-1.683	-1.472	-1.254	-1.030	-0.795	-0.547	-0.292	-0.069
C	v_y	-2.062	-2.057	-2.012	-1.953	-1.895	-1.842	-1.795	-1.744	-1.676	-1.554	-1.300	-0.781
	m_x	-1.250	-1.003	-0.799	-0.633	-0.496	-0.380	-0.279	-0.191	-0.116	-0.054	-0.012	0.004
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.8





h / b = 0.15

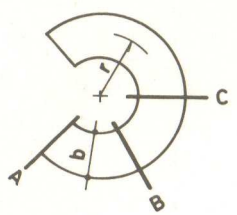
b / r = 0.50

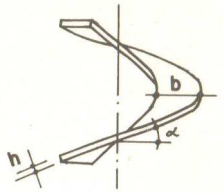
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.729	1.872	1.935	1.914	1.813	1.641	1.404	1.113	0.782	0.443	0.163
	v_x	2.748	2.334	1.955	1.621	1.334	1.090	0.886	0.718	0.580	0.465	0.353	0.209
	v_y	1.530	1.418	1.194	0.906	0.593	0.283	0.000	-0.236	-0.400	-0.459	-0.374	-0.155
	t	0.417	0.199	0.086	0.033	0.009	-0.002	-0.008	-0.011	-0.012	-0.011	-0.009	-0.005
	m_x	-1.545	-1.078	-0.720	-0.470	-0.305	-0.204	-0.146	-0.113	-0.094	-0.077	-0.053	-0.020
	m_y	-0.231	-0.545	-0.836	-1.054	-1.179	-1.208	-1.145	-1.000	-0.785	-0.518	-0.242	-0.045
B	n	2.100	1.971	1.800	1.607	1.406	1.204	1.002	0.802	0.603	0.408	0.225	0.082
	v_x	0.632	0.554	0.499	0.456	0.418	0.380	0.342	0.304	0.264	0.223	0.175	0.104
	v_y	0.000	-0.192	-0.357	-0.491	-0.593	-0.667	-0.711	-0.723	-0.692	-0.599	-0.418	-0.159
	t	0.174	0.091	0.043	0.013	-0.004	-0.014	-0.019	-0.021	-0.019	-0.015	-0.009	-0.003
	m_x	0.312	0.231	0.155	0.095	0.053	0.026	0.012	0.006	0.005	0.005	0.005	0.002
	m_y	-1.846	-1.715	-1.547	-1.362	-1.173	-0.985	-0.802	-0.622	-0.446	-0.276	-0.123	-0.022
C	v_y	-1.530	-1.468	-1.379	-1.282	-1.186	-1.095	-1.005	-0.911	-0.799	-0.649	-0.432	-0.160
	m_x	-0.497	-0.333	-0.212	-0.126	-0.067	-0.026	0.002	0.019	0.029	0.031	0.024	0.009
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.9





h / b = 0.15

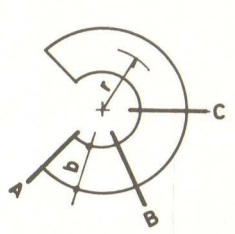
b / r = 0.75

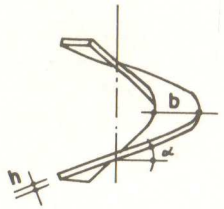
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø°	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.733	1.882	1.949	1.932	1.835	1.663	1.426	1.133	0.797	0.452	0.167
	v_x	2.748	2.332	1.950	1.613	1.324	1.078	0.874	0.706	0.570	0.456	0.348	0.207
	v_y	1.549	1.438	1.213	0.923	0.605	0.290	0.000	-0.243	-0.412	-0.476	-0.392	-0.169
	t	0.389	0.168	0.054	0.001	-0.022	-0.032	-0.035	-0.035	-0.033	-0.028	-0.020	-0.011
	m_x	-1.570	-1.098	-0.735	-0.480	-0.313	-0.209	-0.149	-0.116	-0.096	-0.079	-0.054	-0.020
	m_y	-0.216	-0.534	-0.831	-1.056	-1.186	-1.219	-1.159	-1.015	-0.799	-0.529	-0.248	-0.046
B	n	2.116	1.989	1.818	1.626	1.425	1.221	1.018	0.816	0.615	0.416	0.229	0.083
	v_x	0.623	0.544	0.489	0.446	0.408	0.371	0.333	0.296	0.258	0.219	0.172	0.103
	v_y	0.000	-0.194	-0.363	-0.499	-0.605	-0.682	-0.729	-0.743	-0.714	-0.622	-0.437	-0.173
	t	0.165	0.081	0.031	0.001	-0.016	-0.027	-0.032	-0.032	-0.029	-0.023	-0.015	-0.006
	m_x	0.302	0.221	0.146	0.086	0.044	0.019	0.006	0.001	0.001	0.003	0.004	0.002
	m_y	-1.862	-1.732	-1.564	-1.379	-1.189	-1.001	-0.816	-0.634	-0.455	-0.282	-0.126	-0.023
C	v_y	-1.549	-1.489	-1.401	-1.305	-1.210	-1.120	-1.031	-0.937	-0.825	-0.673	-0.453	-0.175
	m_x	-0.523	-0.357	-0.233	-0.144	-0.081	-0.038	-0.007	0.013	0.025	0.029	0.023	0.009
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.10





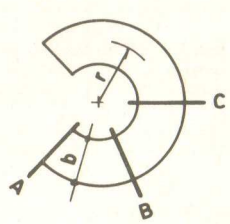
h / b = 0.15

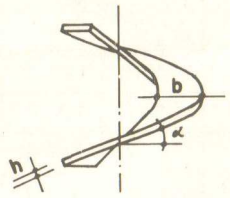
b / r = 1.00

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø°	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.740	1.895	1.969	1.958	1.864	1.695	1.457	1.160	0.818	0.464	0.171
	v_x	2.748	2.328	1.943	1.602	1.309	1.062	0.857	0.689	0.554	0.445	0.341	0.205
	v_y	1.574	1.465	1.240	0.946	0.622	0.299	0.000	-0.252	-0.431	-0.500	-0.417	-0.189
	t	0.350	0.126	0.010	-0.044	-0.066	-0.073	-0.073	-0.070	-0.062	-0.051	-0.036	-0.019
	m_x	-1.606	-1.126	-0.756	-0.495	-0.323	-0.216	-0.154	-0.120	-0.099	-0.081	-0.056	-0.021
	m_y	-0.194	-0.519	-0.824	-1.057	-1.196	-1.235	-1.180	-1.037	-0.818	-0.543	-0.255	-0.047
B	n	2.139	2.014	1.844	1.652	1.450	1.246	1.041	0.836	0.631	0.427	0.236	0.086
	v_x	0.611	0.530	0.475	0.431	0.394	0.357	0.321	0.285	0.249	0.212	0.169	0.102
	v_y	0.000	-0.198	-0.371	-0.512	-0.622	-0.703	-0.755	-0.773	-0.746	-0.653	-0.465	-0.194
	t	0.153	0.067	0.016	-0.016	-0.034	-0.044	-0.049	-0.049	-0.044	-0.035	-0.023	-0.010
	m_x	0.288	0.208	0.133	0.074	0.033	0.008	-0.003	-0.006	-0.004	0.000	0.003	0.002
	m_y	-1.885	-1.757	-1.590	-1.404	-1.213	-1.023	-0.836	-0.651	-0.468	-0.290	-0.130	-0.023
C	v_y	-1.574	-1.517	-1.431	-1.337	-1.244	-1.155	-1.067	-0.974	-0.861	-0.707	-0.481	-0.195
	m_x	-0.561	-0.390	-0.262	-0.169	-0.102	-0.054	-0.020	0.004	0.019	0.026	0.022	0.009
	$n = v_x = t = m_y = 0$												





h / b = 0.15

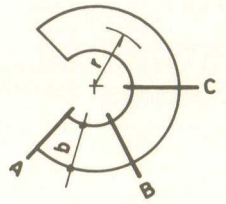
b / r = 1.50

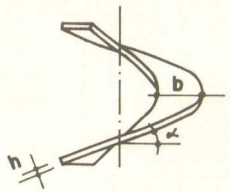
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.758	1.933	2.026	2.031	1.949	1.785	1.546	1.238	0.878	0.500	0.184
	v_x	2.748	2.318	1.922	1.571	1.269	1.015	0.806	0.640	0.511	0.414	0.322	0.197
	v_y	1.648	1.544	1.315	1.011	0.670	0.325	0.000	-0.279	-0.482	-0.563	-0.487	-0.245
	t	0.238	0.003	-0.117	-0.170	-0.189	-0.190	-0.182	-0.167	-0.146	-0.117	-0.083	-0.043
	m_x	-1.708	-1.206	-0.816	-0.538	-0.353	-0.237	-0.168	-0.130	-0.108	-0.088	-0.061	-0.023
	m_y	-0.132	-0.475	-0.804	-1.061	-1.223	-1.281	-1.237	-1.099	-0.875	-0.585	-0.276	-0.051
B	n	2.203	2.084	1.918	1.726	1.523	1.315	1.105	0.892	0.676	0.459	0.254	0.092
	v_x	0.575	0.491	0.434	0.390	0.353	0.319	0.286	0.254	0.224	0.194	0.158	0.099
	v_y	0.000	-0.209	-0.393	-0.547	-0.670	-0.764	-0.828	-0.856	-0.836	-0.743	-0.544	-0.251
	t	0.120	0.027	-0.030	-0.064	-0.084	-0.095	-0.098	-0.095	-0.084	-0.068	-0.046	-0.022
	m_x	0.247	0.169	0.095	0.038	-0.000	-0.021	-0.028	-0.025	-0.017	-0.008	-0.001	-0.001
	m_y	-1.951	-1.827	-1.661	-1.475	-1.281	-1.086	-0.892	-0.698	-0.505	-0.314	-0.141	-0.026
C	v_y	-1.648	-1.598	-1.519	-1.429	-1.341	-1.255	-1.170	-1.079	-0.965	-0.804	-0.563	-0.253
	m_x	-0.667	-0.484	-0.344	-0.239	-0.161	-0.102	-0.057	-0.023	0.003	0.017	0.019	0.009
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.12





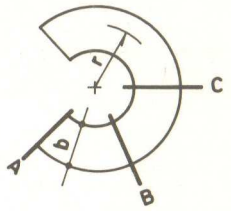
h / b = 0.15

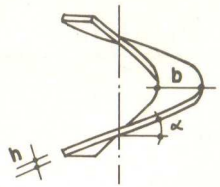
b / r = 2.00

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø°	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.784	1.987	2.106	2.133	2.067	1.912	1.670	1.348	0.962	0.550	0.203
	v_x	2.748	2.304	1.892	1.527	1.212	0.949	0.736	0.571	0.450	0.365	0.294	0.187
	v_y	1.751	1.654	1.421	1.102	0.738	0.361	0.000	-0.317	-0.555	-0.664	-0.586	-0.323
	t	0.081	-0.163	-0.294	-0.348	-0.362	-0.355	-0.335	-0.304	-0.262	-0.210	-0.147	-0.076
	m_x	-1.851	-1.319	-0.900	-0.598	-0.395	-0.266	-0.188	-0.145	-0.119	-0.098	-0.068	-0.025
	m_y	-0.045	-0.414	-0.775	-1.067	-1.260	-1.344	-1.318	-1.185	-0.953	-0.643	-0.305	-0.057
B	n	2.293	2.183	2.021	1.830	1.625	1.412	1.194	0.970	0.739	0.505	0.280	0.102
	v_x	0.525	0.436	0.376	0.332	0.296	0.265	0.236	0.211	0.189	0.169	0.144	0.093
	v_y	0.000	-0.224	-0.425	-0.596	-0.738	-0.849	-0.930	-0.972	-0.961	-0.868	-0.654	-0.332
	t	0.072	-0.030	-0.093	-0.131	-0.154	-0.166	-0.167	-0.159	-0.141	-0.114	-0.078	-0.039
	m_x	0.191	0.115	0.043	-0.012	-0.047	-0.062	-0.063	-0.052	-0.036	-0.019	-0.006	-0.000
	m_y	-2.042	-1.925	-1.761	-1.573	-1.375	-1.174	-0.970	-0.765	-0.556	-0.348	-0.157	-0.029
C	v_y	-1.751	-1.712	-1.641	-1.558	-1.475	-1.395	-1.315	-1.225	-1.110	-0.939	-0.677	-0.335
	m_x	-0.816	-0.616	-0.459	-0.338	-0.244	-0.169	-0.109	-0.060	-0.021	0.005	0.015	0.008
	$n = v_x = t = m_y = 0$												





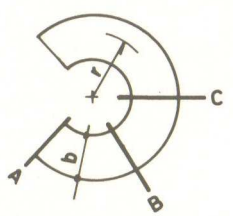
h / b = 0.15

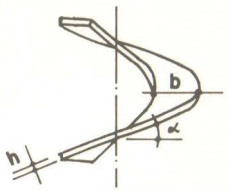
b / r = 2.50

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø°	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.817	2.056	2.209	2.264	2.219	2.074	1.829	1.489	1.069	0.614	0.226
	v_x	2.748	2.286	1.854	1.470	1.140	0.865	0.646	0.483	0.372	0.305	0.258	0.174
	v_y	1.883	1.796	1.557	1.219	0.824	0.408	0.000	-0.366	-0.648	-0.787	-0.713	-0.424
	t	-0.121	-0.388	-0.522	-0.576	-0.584	-0.566	-0.531	-0.479	-0.413	-0.329	-0.230	-0.118
	m_x	-2.035	-1.463	-1.008	-0.675	-0.448	-0.302	-0.214	-0.164	-0.135	-0.110	-0.076	-0.028
	m_y	0.067	-0.335	-0.739	-1.075	-1.309	-1.426	-1.422	-1.296	-1.055	-0.718	-0.343	-0.065
B	n	2.409	2.310	2.154	1.964	1.757	1.537	1.309	1.070	0.821	0.563	0.313	0.114
	v_x	0.461	0.366	0.303	0.258	0.224	0.195	0.173	0.155	0.144	0.137	0.126	0.087
	v_y	0.000	-0.243	-0.465	-0.660	-0.824	-0.959	-1.061	-1.122	-1.122	-1.029	-0.795	-0.436
	t	0.011	-0.102	-0.174	-0.218	-0.245	-0.257	-0.256	-0.242	-0.214	-0.173	-0.120	-0.060
	m_x	0.119	0.046	-0.024	-0.077	-0.107	-0.116	-0.107	-0.087	-0.060	-0.033	-0.012	-0.002
	m_y	-2.160	-2.051	-1.890	-1.700	-1.497	-1.287	-1.072	-0.850	-0.622	-0.392	-0.177	-0.032
C	v_y	-1.883	-1.859	-1.798	-1.724	-1.649	-1.576	-1.501	-1.414	-1.296	-1.114	-0.823	-0.439
	m_x	-1.007	-0.786	-0.607	-0.465	-0.350	-0.255	-0.175	-0.107	-0.051	-0.011	0.009	0.007
	$n = v_x = t = m_y = 0$												





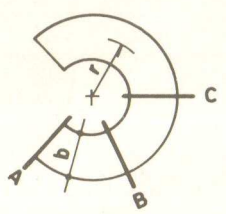
h / b = 0.15

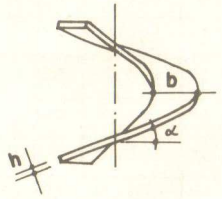
b / r = 3.00

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.857	2.140	2.334	2.425	2.406	2.273	2.024	1.662	1.201	0.692	0.255
	v_x	2.748	2.263	1.807	1.400	1.051	0.762	0.536	0.375	0.276	0.232	0.215	0.158
	v_y	2.045	1.969	1.724	1.363	0.930	0.465	0.000	-0.426	-0.762	-0.938	-0.868	-0.548
	t	-0.367	-0.657	-0.801	-0.855	-0.856	-0.825	-0.770	-0.694	-0.596	-0.475	-0.331	-0.170
	m_x	-2.259	-1.639	-1.139	-0.770	-0.514	-0.348	-0.246	-0.187	-0.153	-0.125	-0.087	-0.032
	m_y	0.204	-0.239	-0.694	-1.084	-1.368	-1.526	-1.549	-1.432	-1.178	-0.809	-0.390	-0.074
B	n	2.550	2.465	2.316	2.128	1.917	1.690	1.449	1.193	0.920	0.634	0.354	0.128
	v_x	0.382	0.280	0.213	0.167	0.135	0.111	0.095	0.087	0.089	0.097	0.103	0.079
	v_y	0.000	-0.266	-0.515	-0.737	-0.930	-1.093	-1.222	-1.305	-1.320	-1.226	-0.968	-0.562
	t	-0.063	-0.191	-0.273	-0.325	-0.355	-0.368	-0.364	-0.343	-0.303	-0.245	-0.171	-0.086
	m_x	0.031	-0.039	-0.106	-0.155	-0.180	-0.181	-0.162	-0.129	-0.090	-0.050	-0.020	-0.004
	m_y	-2.303	-2.204	-2.047	-1.856	-1.646	-1.425	-1.195	-0.955	-0.703	-0.445	-0.202	-0.037
C	v_y	-2.045	-2.038	-1.990	-1.927	-1.861	-1.796	-1.728	-1.645	-1.524	-1.327	-1.003	-0.567
	m_x	-1.241	-0.993	-0.788	-0.620	-0.480	-0.361	-0.256	-0.165	-0.088	-0.030	0.002	0.006
	$n = v_x = t = m_y = 0$												





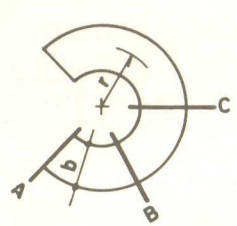
h / b = 0.20

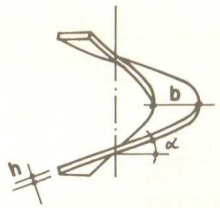
b / r = 0.50

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø°	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.725	1.864	1.920	1.890	1.778	1.590	1.337	1.033	0.702	0.388	0.150
	v_x	2.748	2.337	1.960	1.630	1.347	1.110	0.915	0.755	0.625	0.509	0.383	0.216
	v_y	1.516	1.402	1.177	0.889	0.577	0.272	0.000	- 0.215	- 0.347	- 0.367	- 0.266	- 0.098
	t	0.439	0.221	0.107	0.051	0.025	0.010	0.001	- 0.006	- 0.010	- 0.011	- 0.009	- 0.005
	m_x	- 1.557	- 1.098	- 0.747	- 0.504	- 0.346	- 0.251	- 0.196	- 0.163	- 0.137	- 0.107	- 0.066	- 0.021
	m_y	- 0.243	- 0.552	- 0.836	- 1.045	- 1.157	- 1.168	- 1.084	- 0.916	- 0.681	- 0.414	- 0.171	- 0.027
B	n	2.087	1.957	1.783	1.587	1.382	1.174	0.967	0.760	0.557	0.364	0.197	0.075
	v_x	0.639	0.562	0.508	0.467	0.431	0.397	0.362	0.327	0.290	0.247	0.190	0.108
	v_y	0.000	- 0.189	- 0.352	- 0.481	- 0.577	- 0.641	- 0.670	- 0.660	- 0.600	- 0.480	- 0.297	- 0.101
	t	0.170	0.087	0.037	0.006	- 0.012	- 0.023	- 0.029	- 0.029	- 0.026	- 0.018	- 0.010	- 0.003
	m_x	0.299	0.219	0.145	0.086	0.046	0.021	0.009	0.006	0.006	0.007	0.006	0.002
	m_y	- 1.827	- 1.693	- 1.521	- 1.331	- 1.136	- 0.942	- 0.750	- 0.563	- 0.382	- 0.217	- 0.085	- 0.013
C	v_y	- 1.516	- 1.451	- 1.359	- 1.257	- 1.154	- 1.052	- 0.947	- 0.832	- 0.693	- 0.519	- 0.307	- 0.101
	m_x	- 0.484	- 0.320	- 0.198	- 0.110	- 0.049	- 0.006	0.024	0.042	0.049	0.045	0.030	0.010
	$n = v_x = t = m_y = 0$												





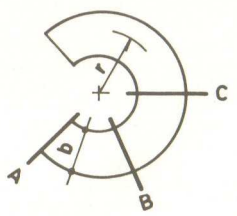
h / b = 0.20

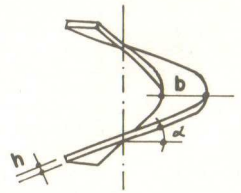
b / r = 0.75

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø°	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.729	1.873	1.934	1.908	1.798	1.612	1.358	1.051	0.715	0.396	0.153
	v_x	2.748	2.334	1.955	1.622	1.337	1.099	0.902	0.744	0.615	0.502	0.379	0.215
	v_y	1.534	1.421	1.196	0.905	0.589	0.279	0.000	-0.222	-0.359	-0.382	-0.281	-0.111
	t	0.412	0.191	0.076	0.020	-0.006	-0.019	-0.026	-0.030	-0.030	-0.027	-0.020	-0.011
	m_x	-1.583	-1.118	-0.762	-0.515	-0.354	-0.257	-0.200	-0.166	-0.140	-0.109	-0.067	-0.022
	m_y	-0.228	-0.541	-0.831	-1.046	-1.163	-1.179	-1.097	-0.930	-0.693	-0.422	-0.175	-0.028
B	n	2.103	1.974	1.801	1.605	1.400	1.191	0.982	0.773	0.567	0.371	0.200	0.077
	v_x	0.630	0.552	0.498	0.457	0.421	0.387	0.354	0.320	0.284	0.243	0.188	0.107
	v_y	0.000	-0.192	-0.357	-0.490	-0.589	-0.655	-0.688	-0.680	-0.621	-0.499	-0.314	-0.114
	t	0.161	0.077	0.026	-0.006	-0.025	-0.036	-0.041	-0.041	-0.036	-0.027	-0.016	-0.006
	m_x	0.289	0.209	0.135	0.077	0.037	0.014	0.003	0.001	0.003	0.006	0.005	0.002
	m_y	-1.843	-1.710	-1.539	-1.349	-1.153	-0.957	-0.763	-0.574	-0.390	-0.222	-0.087	-0.014
C	v_y	-1.534	-1.471	-1.380	-1.280	-1.178	-1.077	-0.972	-0.857	-0.717	-0.541	-0.325	-0.115
	m_x	-0.511	-0.344	-0.219	-0.128	-0.063	-0.017	0.015	0.035	0.045	0.043	0.030	0.010
	$n = v_x = t = m_y = 0$												



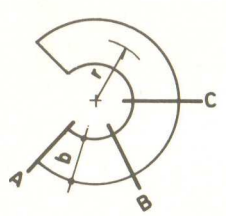


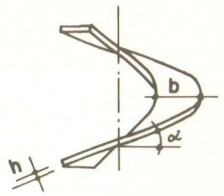
h / b = 0.20
b / r = 1.00
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.736	1.886	1.953	1.933	1.827	1.642	1.388	1.076	0.734	0.407	0.157
	v_x	2.748	2.331	1.948	1.611	1.323	1.083	0.886	0.728	0.601	0.491	0.373	0.212
	v_y	1.559	1.448	1.222	0.927	0.606	0.288	0.000	-0.231	-0.375	-0.404	-0.303	-0.129
	t	0.373	0.149	0.032	-0.024	-0.049	-0.059	-0.064	-0.064	-0.060	-0.050	-0.036	-0.019
	m_x	-1.619	-1.146	-0.784	-0.530	-0.366	-0.265	-0.206	-0.171	-0.144	-0.113	-0.069	-0.022
	m_y	-0.207	-0.525	-0.824	-1.047	-1.172	-1.194	-1.116	-0.949	-0.710	-0.434	-0.180	-0.029
B	n	2.125	1.998	1.826	1.631	1.425	1.215	1.004	0.792	0.582	0.381	0.206	0.079
	v_x	0.618	0.539	0.484	0.443	0.407	0.374	0.342	0.309	0.276	0.238	0.185	0.106
	v_y	0.000	-0.196	-0.365	-0.502	-0.606	-0.676	-0.712	-0.707	-0.650	-0.527	-0.338	-0.132
	t	0.150	0.063	0.010	-0.022	-0.042	-0.054	-0.058	-0.057	-0.050	-0.038	-0.024	-0.010
	m_x	0.274	0.195	0.122	0.064	0.025	0.003	-0.006	-0.006	-0.002	0.003	-0.004	0.002
	m_y	-1.866	-1.735	-1.563	-1.373	-1.176	-0.978	-0.782	-0.589	-0.401	-0.229	-0.090	-0.014
C	v_y	-1.559	-1.499	-1.411	-1.311	-1.211	-1.111	-1.007	-0.891	-0.751	-0.571	-0.350	-0.133
	m_x	-0.548	-0.377	-0.247	-0.153	-0.084	-0.034	0.002	0.027	0.040	0.041	0.029	0.010
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.18





h / b = 0.20

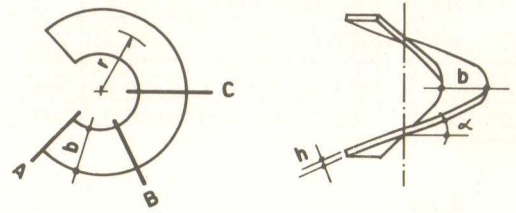
b / r = 1.50

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø °	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.754	1.942	2.009	2.004	1.909	1.729	1.472	1.149	0.787	0.438	0.169
	v_x	2.748	2.321	1.927	1.580	1.284	1.037	0.837	0.681	0.561	0.462	0.356	0.206
	v_y	1.632	1.526	1.296	0.991	0.653	0.313	0.000	-0.256	-0.423	-0.464	-0.364	-0.179
	t	0.263	0.028	-0.093	-0.149	-0.171	-0.176	-0.172	-0.161	-0.143	-0.116	-0.082	-0.043
	m_x	-1.721	-1.227	-0.845	-0.575	-0.398	-0.288	-0.224	-0.186	-0.156	-0.122	-0.075	-0.024
	m_y	-0.146	-0.483	-0.804	-1.051	-1.198	-1.237	-1.170	-1.005	-0.759	-0.467	-0.195	-0.031
B	n	2.188	2.068	1.899	1.704	1.497	1.283	1.065	0.845	0.624	0.410	0.222	0.085
	v_x	0.583	0.500	0.444	0.402	0.368	0.337	0.308	0.280	0.253	0.222	0.176	0.103
	v_y	0.000	-0.206	-0.387	-0.537	-0.653	-0.736	-0.783	-0.786	-0.733	-0.607	-0.406	-0.184
	t	0.117	0.023	-0.035	-0.071	-0.092	-0.104	-0.108	-0.104	-0.091	-0.071	-0.047	-0.022
	m_x	0.233	0.156	0.083	0.028	-0.009	-0.027	-0.031	-0.026	-0.015	-0.005	0.001	0.001
	m_y	-1.930	-1.803	-1.634	-1.442	-1.242	-1.038	-0.835	-0.632	-0.433	-0.248	-0.098	-0.015
C	v_y	-1.632	-1.580	-1.497	-1.402	-1.306	-1.208	-1.107	-0.991	-0.846	-0.657	-0.420	-0.186
	m_x	-0.654	-0.471	-0.330	-0.223	-0.142	-0.081	-0.034	0.001	0.024	0.033	0.026	0.010
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.19



h / b = 0.20

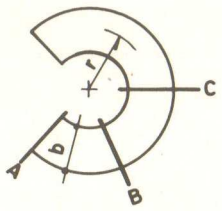
b / r = 2.00

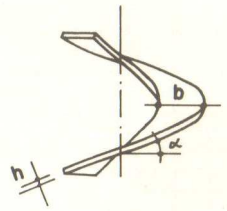
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø°	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.779	1.976	2.088	2.104	2.025	1.851	1.589	1.250	0.861	0.481	0.186
	v_x	2.748	2.306	1.898	1.537	1.228	0.973	0.770	0.616	0.505	0.421	0.332	0.196
	v_y	1.733	1.634	1.400	1.081	0.719	0.348	0.000	-0.292	-0.490	-0.550	-0.449	-0.251
	t	0.109	-0.140	-0.268	-0.324	-0.342	-0.338	-0.323	-0.296	-0.259	-0.209	-0.147	-0.076
	m_x	-1.864	-1.340	-0.930	-0.637	-0.442	-0.321	-0.249	-0.205	-0.173	-0.135	-0.084	-0.027
	m_y	-0.060	-0.423	-0.776	-1.056	-1.234	-1.298	-1.246	-1.083	-0.827	-0.513	-0.215	-0.035
B	n	2.277	2.165	2.001	1.807	1.597	1.378	1.151	0.919	0.682	0.451	0.244	0.093
	v_x	0.534	0.446	0.338	0.346	0.312	0.284	0.260	0.239	0.221	0.199	0.164	0.098
	v_y	0.000	-0.221	-0.419	-0.585	-0.719	-0.819	-0.881	-0.896	-0.849	-0.718	-0.501	-0.257
	t	0.070	-0.033	-0.098	-0.138	-0.163	-0.175	-0.177	-0.169	-0.148	-0.118	-0.080	-0.039
	m_x	0.175	0.101	0.030	-0.024	-0.056	-0.069	-0.067	-0.053	-0.034	-0.016	-0.004	-0.000
	m_y	-2.020	-1.900	-1.732	-1.539	-1.334	-1.123	-0.909	-0.693	-0.478	-0.275	-0.109	-0.017
C	v_y	-1.733	-1.692	-1.617	-1.529	-1.438	-1.345	-1.246	-1.130	-0.930	-0.777	-0.519	-0.259
	m_x	-0.803	-0.603	-0.445	-0.321	-0.225	-0.147	-0.084	-0.034	0.003	0.022	0.023	0.009
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.20





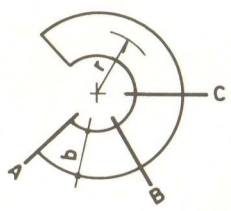
h / b = 0.20

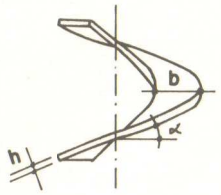
b / r = 2.50

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Øo	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.812	2.044	2.189	2.233	2.173	2.008	1.740	1.380	0.957	0.536	0.207
	v_x	2.748	2.288	1.860	1.481	1.157	0.891	0.683	0.532	0.433	0.367	0.302	0.185
	v_y	1.863	1.774	1.534	1.196	0.804	0.394	0.000	-0.339	-0.576	-0.659	-0.559	-0.342
	t	-0.090	-0.357	-0.493	-0.549	-0.561	-0.548	-0.517	-0.471	-0.408	-0.328	-0.230	-0.118
	m_x	-2.048	-1.485	-1.039	-0.717	-0.500	-0.362	-0.280	-0.231	-0.194	-0.152	-0.095	-0.031
	m_y	0.050	-0.345	-0.740	-1.063	-1.281	-1.376	-1.343	-1.184	-0.914	-0.572	-0.242	-0.039
B	n	2.391	2.290	2.131	1.938	1.725	1.499	1.262	1.014	0.757	0.502	0.273	0.104
	v_x	0.471	0.377	0.315	0.273	0.241	0.217	0.198	0.187	0.179	0.171	0.148	0.092
	v_y	0.000	-0.240	-0.459	-0.648	-0.804	-0.926	-1.008	-1.038	-0.997	-0.861	-0.623	-0.351
	t	0.010	-0.105	-0.178	-0.225	-0.253	-0.266	-0.266	-0.252	-0.222	-0.177	-0.121	-0.060
	m_x	0.101	0.030	-0.039	-0.090	-0.117	-0.124	-0.112	-0.088	-0.058	-0.030	-0.010	-0.002
	m_y	-2.136	-2.023	-1.858	-1.663	-1.452	-1.232	-1.004	-0.771	-0.535	-0.310	-0.124	-0.020
C	v_y	-1.863	-1.836	-1.772	-1.692	-1.608	-1.521	-1.425	-1.308	-1.151	-0.932	-0.645	-0.354
	m_x	-0.994	-0.773	-0.593	-0.448	-0.330	-0.232	-0.149	-0.079	-0.025	0.009	0.018	0.008
	$n = v_x = t = m_y = 0$												





h / b = 0.20

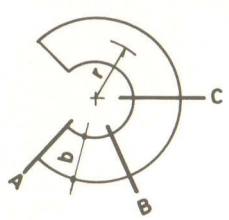
b / r = 3.00

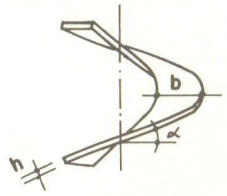
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.852	2.127	2.312	2.391	2.354	2.199	1.924	1.539	1.074	0.604	0.233
	v_x	2.748	2.266	1.814	1.412	1.070	0.790	0.577	0.430	0.344	0.303	0.264	0.170
	v_y	2.022	1.944	1.698	1.337	0.908	0.449	0.000	-0.395	-0.681	-0.793	-0.693	-0.454
	t	-0.332	-0.622	-0.768	-0.825	-0.830	-0.803	-0.754	-0.684	-0.591	-0.473	-0.331	-0.170
	m_x	-2.272	-1.663	-1.173	-0.814	-0.570	-0.413	-0.319	-0.262	-0.220	-0.173	-0.108	-0.035
	m_y	0.184	-0.251	-0.695	-1.072	-1.338	-1.471	-1.461	-1.307	-1.021	-0.645	-0.274	-0.045
B	n	2.530	2.443	2.291	2.099	1.883	1.648	1.397	1.130	0.849	0.566	0.308	0.117
	v_x	0.394	0.292	0.227	0.183	0.154	0.134	0.123	0.122	0.128	0.135	0.129	0.085
	v_y	0.000	-0.263	-0.508	-0.724	-0.908	-1.056	-1.162	-1.211	-1.179	-1.036	-0.773	-0.466
	t	-0.063	-0.193	-0.276	-0.330	-0.363	-0.378	-0.375	-0.354	-0.312	-0.250	-0.172	-0.086
	m_x	0.011	-0.057	-0.123	-0.170	-0.192	-0.190	-0.168	-0.131	-0.088	-0.048	-0.018	-0.003
	m_y	-2.277	-2.175	-2.012	-1.815	-1.597	-1.365	-1.121	-0.866	-0.605	-0.352	-0.141	-0.022
C	v_y	-2.022	-2.012	-1.961	-1.891	-1.816	-1.735	-1.644	-1.527	-1.361	-1.122	-0.800	-0.470
	m_x	-1.228	-0.980	-0.773	-0.603	-0.460	-0.336	-0.228	-0.134	-0.059	-0.008	0.012	0.007
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.22





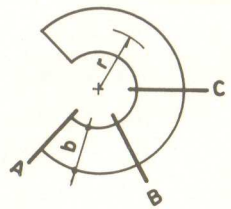
$h/b = 0.25$

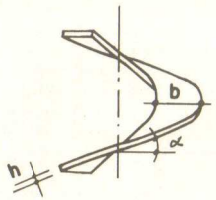
$b/r = 0.50$

$\alpha = 29°$

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.720	1.853	1.901	1.861	1.735	1.534	1.268	0.958	0.637	0.353	0.143
	v_x	2.748	2.339	1.966	1.640	1.363	1.133	0.946	0.794	0.666	0.545	0.403	0.220
	v_y	1.498	1.382	1.155	0.867	0.558	0.259	0.000	-0.194	-0.297	-0.293	-0.196	-0.068
	t	0.467	0.248	0.132	0.074	0.044	0.025	0.011	0.000	-0.007	-0.010	-0.009	-0.005
	m_x	-1.573	-1.122	-0.780	-0.545	-0.396	-0.306	-0.252	-0.215	-0.178	-0.131	-0.074	-0.022
	m_y	-0.259	-0.561	-0.836	-1.033	-1.129	-1.121	-1.016	-0.827	-0.584	-0.330	-0.125	-0.018
B	n	2.071	1.938	1.762	1.562	1.353	1.140	0.927	0.716	0.514	0.329	0.178	0.072
	v_x	0.648	0.572	0.520	0.481	0.447	0.416	0.384	0.351	0.314	0.266	0.201	0.110
	v_y	0.000	-0.187	-0.345	-0.469	-0.558	-0.610	-0.624	-0.594	-0.514	-0.383	-0.219	-0.070
	t	0.165	0.081	0.029	-0.002	-0.022	-0.034	-0.039	-0.038	-0.031	-0.021	-0.011	-0.003
	m_x	0.283	0.205	0.132	0.075	0.037	0.016	0.007	0.006	0.008	0.009	0.007	0.002
	m_y	-1.804	-1.666	-1.490	-1.294	-1.093	-0.891	-0.692	-0.500	-0.322	-0.170	-0.061	-0.009
C	v_y	-1.498	-1.430	-1.334	-1.227	-1.116	-1.003	-0.883	-0.749	-0.594	-0.415	-0.226	-0.071
	m_x	-0.469	-0.304	-0.181	-0.091	-0.027	0.013	0.048	0.065	0.068	0.057	0.034	0.011
	$n = v_x = t = m_y = 0$												





h / b = 0.25

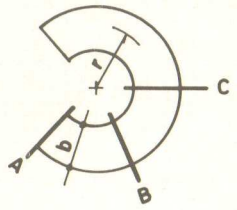
b / r = 0.75

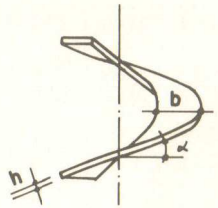
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.724	1.862	1.915	1.878	1.755	1.554	1.237	0.974	0.649	0.360	0.146
	v_x	2.748	2.337	1.961	1.633	1.354	1.122	0.934	0.783	0.657	0.538	0.399	0.219
	v_y	1.515	1.401	1.174	0.883	0.569	0.266	0.000	-0.200	-0.308	-0.307	-0.210	-0.081
	t	0.440	0.218	0.102	0.044	0.014	-0.003	-0.016	-0.024	-0.028	-0.027	-0.020	-0.011
	m_x	-1.599	-1.142	-0.796	-0.557	-0.404	-0.313	-0.257	-0.219	-0.182	-0.134	-0.076	-0.022
	m_y	-0.244	-0.550	-0.831	-1.034	-1.135	-1.131	-1.028	-0.840	-0.594	-0.336	-0.127	-0.019
B	n	2.087	1.955	1.780	1.580	1.370	1.156	0.941	0.729	0.523	0.336	0.182	0.073
	v_x	0.639	0.562	0.510	0.471	0.438	0.407	0.376	0.344	0.309	0.263	0.199	0.109
	v_y	0.000	-0.189	-0.351	-0.478	-0.569	-0.625	-0.641	-0.613	-0.533	-0.401	-0.234	-0.083
	t	0.157	0.071	0.018	-0.014	-0.035	-0.047	-0.051	-0.050	-0.042	-0.030	-0.016	-0.006
	m_x	0.273	0.194	0.122	0.066	0.028	0.008	0.000	0.001	0.005	0.007	0.006	0.002
	m_y	-1.819	-1.683	-1.507	-1.311	-1.108	-0.905	-0.704	-0.510	-0.329	-0.174	-0.063	-0.009
C	v_y	-1.515	-1.450	-1.355	-1.249	-1.139	-1.026	-0.907	-0.773	-0.616	-0.434	-0.242	-0.083
	m_x	-0.495	-0.328	-0.201	-0.109	-0.042	0.006	0.039	0.059	0.064	0.055	0.034	0.010
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.24





h / b = 0.25

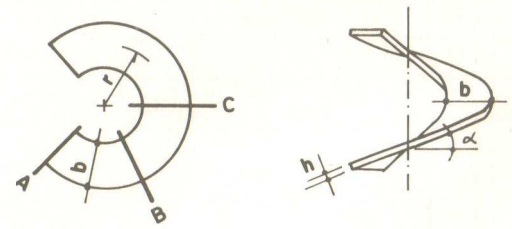
b / r = 1.00

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø °	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.731	1.875	1.934	1.902	1.783	1.584	1.315	0.998	0.666	0.369	0.150
	v_x	2.748	2.333	1.954	1.622	1.340	1.107	0.918	0.768	0.644	0.529	0.394	0.216
	v_y	1.540	1.427	1.199	0.905	0.586	0.274	0.000	-0.208	-0.323	-0.326	-0.229	-0.097
	t	0.402	0.177	0.059	0.001	-0.028	-0.044	-0.053	-0.058	-0.057	-0.050	-0.036	-0.019
	m_x	-1.634	-1.171	-0.818	-0.573	-0.417	-0.322	-0.265	-0.226	-0.187	-0.138	-0.078	-0.023
	m_y	-0.223	-0.535	-0.824	-1.035	-1.144	-1.146	-1.045	-0.857	-0.609	-0.346	-0.131	-0.019
B	n	2.109	1.979	1.805	1.605	1.395	1.179	0.962	0.746	0.537	0.345	0.187	0.075
	v_x	0.627	0.549	0.496	0.457	0.424	0.394	0.365	0.335	0.301	0.258	0.196	0.108
	v_y	0.000	-0.193	-0.358	-0.490	-0.586	-0.645	-0.665	-0.639	-0.560	-0.426	-0.255	-0.100
	t	0.145	0.057	0.003	-0.031	-0.052	-0.064	-0.069	-0.066	-0.056	-0.041	-0.025	-0.010
	m_x	0.258	0.180	0.108	0.053	0.016	-0.003	-0.009	-0.006	0.000	0.005	0.005	0.002
	m_y	-1.841	-1.707	-1.531	-1.335	-1.131	-0.925	-0.722	-0.524	-0.339	-0.179	-0.065	-0.009
C	v_y	-1.540	-1.478	-1.385	-1.280	-1.171	-1.059	-0.940	-0.805	-0.647	-0.461	-0.264	-0.101
	m_x	-0.532	-0.361	-0.230	-0.133	-0.062	-0.010	0.027	0.050	0.059	0.053	0.033	0.010
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.25



h / b = 0.25

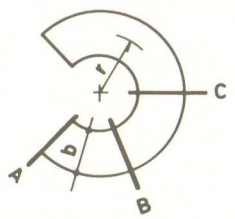
b / r = 1.50

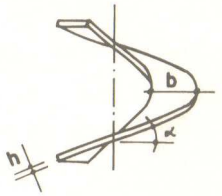
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	ϕ_o	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.748	1.912	1.989	1.972	1.863	1.667	1.394	1.064	0.714	0.397	0.161
	v_x	2.748	2.324	1.934	1.592	1.301	1.063	0.872	0.724	0.608	0.502	0.379	0.210
	v_y	1.611	1.503	1.272	0.968	0.632	0.299	0.000	-0.233	-0.367	-0.381	-0.284	-0.146
	t	0.294	0.059	-0.064	-0.123	-0.148	-0.153	-0.160	-0.154	-0.139	-0.115	-0.082	-0.043
	m_x	-1.737	-1.252	-0.880	-0.620	-0.451	-0.348	-0.286	-0.244	-0.202	-0.150	-0.085	-0.025
	m_y	-0.163	-0.493	-0.804	-1.039	-1.169	-1.187	-1.095	-0.907	-0.650	-0.372	-0.142	-0.081
B	n	2.171	2.047	1.876	1.677	1.465	1.245	1.021	0.796	0.575	0.371	0.201	
	v_x	0.593	0.511	0.457	0.417	0.386	0.358	0.332	0.307	0.280	0.244	0.188	0.105
	v_y	0.000	-0.203	-0.380	-0.524	-0.632	-0.702	-0.732	-0.713	-0.636	-0.498	-0.316	-0.149
	t	0.113	0.018	-0.041	-0.079	-0.102	-0.115	-0.119	-0.113	-0.098	-0.075	-0.048	-0.022
	m_x	0.215	0.140	0.069	0.015	-0.019	-0.034	-0.035	-0.026	-0.014	-0.003	0.002	0.001
	m_y	-1.904	-1.774	-1.600	-1.402	-1.194	-0.923	-0.771	-0.563	-0.366	-0.194	-0.071	-0.010
C	v_y	-1.611	-1.556	-1.469	-1.369	-1.263	-1.154	-1.035	-0.899	-0.735	-0.539	-0.328	-0.151
	m_x	-0.638	-0.455	-0.312	-0.203	-0.120	-0.056	-0.008	0.026	0.045	0.046	0.031	0.010
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.26





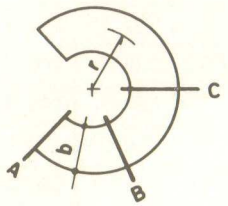
h / b = 0.25

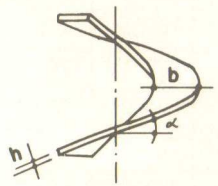
b / r = 2.00

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	$\emptyset_o$	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.773	1.963	2.066	2.070	1.975	1.784	1.504	1.157	0.781	0.436	0.177
	v_x	2.748	2.310	1.905	1.549	1.247	1.001	0.807	0.663	0.556	0.465	0.357	0.201
	v_y	1.710	1.609	1.375	1.056	0.696	0.333	0.000	-0.267	-0.429	-0.458	-0.360	-0.213
	t	0.143	-0.106	-0.236	-0.295	-0.317	-0.319	-0.309	-0.288	-0.255	-0.208	-0.147	-0.076
	m_x	-1.880	-1.366	-0.967	-0.684	-0.499	-0.385	-0.316	-0.269	-0.223	-0.166	-0.095	-0.028
	m_y	-0.079	-0.434	-0.777	-1.043	-1.203	-1.244	-1.165	-0.977	-0.708	-0.408	-0.157	-0.023
B	n	2.257	2.143	1.976	1.777	1.562	1.337	1.104	0.865	0.629	0.407	0.221	0.089
	v_x	0.545	0.459	0.402	0.362	0.331	0.307	0.286	0.269	0.250	0.223	0.177	0.101
	v_y	0.000	-0.218	-0.411	-0.571	-0.696	-0.783	-0.826	-0.817	-0.743	-0.598	-0.402	-0.219
	t	0.067	-0.037	-0.103	-0.146	-0.172	-0.186	-0.189	-0.178	-0.155	-0.121	-0.080	-0.039
	m_x	0.156	0.083	0.014	-0.038	-0.068	-0.077	-0.071	-0.054	-0.033	-0.014	-0.003	-0.000
	m_y	-1.992	-1.868	-1.696	-1.496	-1.283	-1.063	-0.840	-0.618	-0.404	-0.216	-0.079	-0.011
C	v_y	-1.710	-1.666	-1.587	-1.493	-1.392	-1.286	-1.169	-1.030	-0.857	-0.647	-0.416	-0.220
	m_x	-0.787	-0.587	-0.427	-0.301	-0.202	-0.122	-0.057	-0.007	0.025	0.036	0.027	0.009
	$n = v_x = t = m_y = 0$												





h / b = 0.25

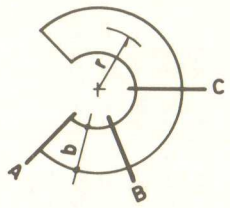
b / r = 2.50

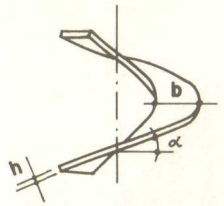
α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø °	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.805	2.030	2.164	2.196	2.119	1.934	1.647	1.277	0.867	0.486	0.197
	v_x	2.748	2.292	1.868	1.494	1.178	0.921	0.724	0.584	0.490	0.417	0.330	0.190
	v_y	1.838	1.746	1.506	1.169	0.779	0.377	0.000	-0.310	-0.508	-0.556	-0.459	-0.300
	t	-0.051	-0.319	-0.457	-0.517	-0.533	-0.525	-0.501	-0.462	-0.404	-0.326	-0.229	-0.118
	m_x	-2.064	-1.513	-1.078	-0.768	-0.561	-0.432	-0.354	-0.301	-0.251	-0.187	-0.107	-0.032
	m_y	0.029	-0.358	-0.741	-1.050	-1.247	-1.317	-1.254	-1.067	-0.782	-0.455	-0.176	-0.026
B	n	2.369	2.266	2.104	1.907	1.683	1.455	1.210	0.955	0.698	0.454	0.247	0.099
	v_x	0.483	0.391	0.331	0.290	0.262	0.241	0.228	0.219	0.212	0.198	0.163	0.095
	v_y	0.000	-0.236	-0.450	-0.632	-0.779	-0.887	-0.948	-0.950	-0.879	-0.727	-0.512	-0.308
	t	0.008	-0.108	-0.183	-0.232	-0.262	-0.278	-0.278	-0.263	-0.230	-0.181	-0.122	-0.060
	m_x	0.079	0.010	-0.057	-0.106	-0.131	-0.133	-0.118	-0.090	-0.057	-0.028	-0.010	-0.002
	m_y	-2.106	-1.939	-1.819	-1.617	-1.397	-1.167	-0.929	-0.688	-0.453	-0.244	-0.089	-0.013
C	v_y	-1.838	-1.808	-1.739	-1.653	-1.558	-1.456	-1.340	-1.198	-1.015	-0.786	-0.530	-0.310
	m_x	-0.978	-0.756	-0.575	-0.428	-0.307	-0.205	-0.120	-0.050	-0.001	0.024	0.023	0.009
	$n = v_x = t = m_y = 0$												

TABLA Nº 8.28





h / b = 0.25

b / r = 3.00

α = 29°

COEFICIENTES PARA EL CALCULO DE SOLICITACIONES

	Ø°	360°	330°	300°	270°	240°	210°	180°	150°	120°	90°	60°	30°
A	n	1.523	1.845	2.111	2.285	2.349	2.294	2.117	1.820	1.423	0.972	0.546	0.222
	v_x	2.748	2.270	1.823	1.427	1.093	0.824	0.623	0.488	0.409	0.359	0.296	0.176
	v_y	1.994	1.913	1.667	1.307	0.881	0.431	0.000	-0.363	-0.604	-0.676	-0.579	-0.406
	t	-0.289	-0.579	-0.727	-0.787	-0.798	-0.778	-0.736	-0.673	-0.586	-0.471	-0.330	-0.170
	m_x	-2.289	-1.692	-1.215	-0.869	-0.637	-0.490	-0.401	-0.340	-0.284	-0.212	-0.122	-0.036
	m_y	0.160	-0.265	-0.697	-1.057	-1.302	-1.407	-1.364	-1.177	-0.872	-0.512	-0.199	-0.030
B	n	2.505	2.416	2.261	2.064	1.841	1.599	1.339	1.065	0.782	0.511	0.278	0.111
	v_x	0.407	0.307	0.244	0.203	0.177	0.161	0.156	0.158	0.165	0.166	0.145	0.088
	v_y	0.000	-0.259	-0.498	-0.707	-0.881	-1.013	-1.096	-1.113	-1.047	-0.884	-0.646	-0.416
	t	-0.064	-0.195	-0.281	-0.337	-0.373	-0.390	-0.388	-0.365	-0.320	-0.254	-0.173	-0.086
	m_x	-0.014	-0.080	-0.144	-0.188	-0.207	-0.201	-0.175	-0.134	-0.087	-0.046	-0.017	-0.003
	m_y	-2.244	-2.137	-1.970	-1.765	-1.537	-1.294	-1.038	-0.774	-0.513	-0.278	-0.102	-0.015
C	v_y	-1.994	-1.981	-1.925	-1.848	-1.761	-1.664	-1.550	-1.403	-1.209	-0.957	-0.669	-0.420
	m_x	-1.211	-0.963	-0.755	-0.582	-0.435	-0.308	-0.197	-0.103	-0.033	0.008	0.018	0.008
	$n = v_x = t = m_y = 0$												

ESCALERAS HELICOIDALES

CALCULAR LA ESCALERA HELICOIDAL CORRESPONDIENTE A :

DATOS :

$b = 2.40$ m. $\quad r = 3.20$ m.
$h = 0.24$ m. $\quad \phi_o = 120°$
α = PENDIENTE DEL HELICOIDE = 29°
q = CARGA POR METRO CUADRADO DE PROYECCION HORIZONTAL = 1000 K/m²

SE DESEAN CALCULAR LAS SOLICITACIONES EN:
SECCION A
SECCION B
SECCION C

1- SE CALCULAN LOS VALORES :

$$\frac{h}{b} = \frac{0.24}{2.40} = 0.10 \qquad \frac{b}{r} = \frac{2.40}{3.20} = 0.75$$

2- DE LA TABLA CORRESPONDIENTE á $h/b = 0.10$ y $b/r = 0.75$, SE TOMAN LOS VALORES DE LOS COEFICIENTES EN LA COLUMNA $\phi_o = 120°$

3- PARA LAS SOLICITACIONES EN EL APOYO = SECCION A

$N = n q r^2 = 1.209 \times 1000 \times 3.20 = 3868.8$ Kg.
$V_x = v_x q r^2 = 0.527 \times 1000 \times 3.20 = 1686.4$ Kg.
$V_y = v_y q r^2 = -0.463 \times 1000 \times 3.20 = -1481.6$ Kg.
$M_t = t q r^2 = -0.035 \times 1000 \times (3.20)^2 = -358.4$ K-m.
$M_x = m_x q r^2 = -0.055 \times 1000 \times (3.20)^2 = -563.2$ K-m.
$M_y = m_y q r^2 = -0.897 \times 1000 \times (3.20)^2 = -9185.28$ K-m.

4- CON LOS COEFICIENTES CORRESPONDIENTES á 1/4 L OBTENEMOS:

$N = n q r^2 = 0.659 \times 1000 \times 3.20 = 2108.8$ Kg.
$V_x = v_x q r^2 = 0.233 \times 1000 \times 3.20 = 745.6$ Kg.
$V_y = v_y q r^2 = -0.802 \times 1000 \times 3.20 = -2566.4$ Kg.
$M_t = t q r^2 = -0.023 \times 1000 \times (3.20)^2 = -235.52$ K-m.
$M_x = m_x q r^2 = -0.001 \times 1000 \times (3.20)^2 = -10.24$ K-m.
$M_y = m_y q r^2 = -0.516 \times 1000 \times (3.20)^2 = -5283.84$ K-m.

5- PARA 1/2 L :

$N = V_x = T = M_y = 0$
$V_y = v_y q r^2 = -0.926 \times 1000 \times 3.20 = -2963.2$ Kg.
$M_x = m_x q r^2 = 0.006 \times 1000 \times (3.20)^2 = 61.44$ K-m.